

Application No. 10/501,431
Amendment dated November 21, 2005
Reply to Office Action of 08/23/2005

REMARKS/ARGUMENTS

The above amendment and the following remarks/arguments are submitted in reply to the Office action dated 08/23/05. In light of these, reconsideration and further examination of this application are respectfully requested pursuant to 37 CFR §1.111.

In the above amendment, claim 1 was amended. Accordingly, sixteen claims (1-16) remain pending in this application.

In section 4 of the Office action, the Examiner rejected claims 1-6 and 11-16 under 35 U.S.C. §103(a) as being unpatentable over Wojnarowski et al. (U.S. Pat. 5,900,674) in view of Brodsky et al. (U.S. Pat. 5,938,454), stating that Wojnarowski teaches all of the limitations of claims 1-4, 11, and 13-16, except for the present invention's teachings relating to the use of "sharp upstanding peaks" of a eutectic material to form a homogeneous soldered joint, and/or a hermetic seal, between pads on two opposing substrates, without the use of a flux or reducing atmosphere, but that Brodsky supplies these deficiencies of teaching, and that it would have been obvious to modify the teachings of Wojnarowski with those of Brodsky to arrive at the present invention. In light of the following remarks and arguments, this rejection is respectfully traversed.

Wojnarowski et al. (the '674) deals with methods for providing "highly compliant electrically conductive interconnections" between two structures having differing coefficients of thermal expansion ("CTE") by the provision of so-called "floating pads" that permit independent movement between two structures in response to thermal stresses acting on the structures so as to minimize thermal stress/strain at elevated temperatures ('674, col. 1, lines 46-67; col. 2, lines 1-9.)

In particular, the '674 (Figs. 15, 16, col. 7, lines 61-67) describes electrically interconnecting "array pads" 112 on a PC board 110 with array pads 118 on a "multichip module (MCM)" 116 by means of various types of "interface structures" 122, 124, 126, 128, 131 (Fig. 16, col. 8, lines 14-67, col. 9, lines 1-16). While the composition of these interface structures varies, they all have in common that,

"Each of the interface structures has [a] partially open interior to form *a compliant joint* between contact areas that it couples. 'Partially open interior' means *an interior that includes air (open spaces) or a compliant material [e.g., rubber] in addition to the metal that is used to electrically couple the contact areas.*" (Col. 8, lines 16-21, emphasis added.)

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One of these interface structures 122 (which the Examiner erroneously identified as a "frame around the periphery of the first surface of the die") is in fact described as,

"a crushed wire assembly 122 which can be fabricated by pressing very fine metal wires into a structure having an appearance similar to that of steel wool and which ... [is] available ... under the trademark name of FUZZ buttons." (Col. 8, lines 22-29.)

Thus, it may be seen that the "steel wool"-like, crushed-wire "interface structures" of Wojnarowski, together with the method by which they are created and used, are distinctly different from those of the "solid, homogeneous, electrically conductive joints" (claim 1) of the present invention, and further, because of the porous, or "partially open interior," of the '674 interface structures, there is no teaching or suggestion whatsoever in Wojnarowski that such structures can be used to effect a hermetic seal of a chip size semiconductor package, as particularly pointed out and distinctly claimed in, *e.g.*, claim 3 of the present invention.

Indeed, regarding this latter distinction, the '674 reference teaches that,

"[The] Crushed wire assemblies can also include removable insulation or solder resist if desired to further inhibit solder wicking into [the] crushed wires. Such solder wicking would *reduce the flexibility of [the] interfaces*." (Col. 9, lines 3-6, emphasis added.)

Accordingly, not only does Wojnarowski not teach or suggest the "solid, homogeneous, electrically conductive joints" of claim 1 of the present invention, which are capable of effecting a true hermetic seal, but in fact, teaches directly away from such structures and methods for making and using them.

An examination of the Brodsky et al. reference (the '454) reveals that it supplies none of the deficiencies in teaching of the Wojnarowski et al reference discussed above. In particular, the '454 teaches a two-part "electrical connector" 50 for coupling "two circuitized substrates" (*e.g.*, a ball grid array module 52 and a printed circuit board 51) in electrical connection with each other using a purely mechanical connection, *i.e.*, without the use of soldered joints. In fact, contrary to the Examiner's assertion, there is no teaching or suggestion anywhere in the '454 for the limitations,

"heating the opposing pads to at least the soldering temperature of the eutectic alloy and until the at least one sharp upstanding peak on the at least one pad penetrates through any oxide films on the respective upper surfaces of the pads and contacts the upper surface of the opposing other pad, *thereby initiating melting and dissolution of the respective upper portions of the opposing pads, including the sharp upstanding peaks, into each other,*"

or,

"cooling the opposing pads to solidify the dissolved, molten upper portions thereof into *a solid, homogeneous, electrically conductive joint between the pads,*"

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of independent claim 1 of the present invention.

Rather, the '454 teaches only that the opposing lands 61 on the substrates may be plated with "dendritic structures" 63, made of "palladium, nickel or alloys thereof," to "enhance electrical connections between the first and second circuitized members and [an optional] interposer 59." ('454, Figs. 1, 4 and 5, col. 4, lines 7-15.) It is clear from the foregoing that the "dendritic structures 63" are not functionally equivalent to the "sharp upstanding peaks" of the present invention – they do not and cannot enter into the melting and dissolution of the upper portions of the opposing pads into each other because 1) there is no heating, and hence, no melting, going on in the non-soldered electrical joints of the '454, and, 2) even if there were, the melting temperatures of the dendritic structure materials so far exceed those of known solder joint materials as to ensure that the structures would not melt and dissolve into a resulting "solid, homogenous joint" that is capable of effecting a hermetic seal.

Accordingly, it is respectfully submitted that independent claim 1 of the present invention, and hence, the claims properly dependent from it, including claims 2-16, are patentably distinguishable over both Wojnarowski et al. and Brodsky et al., whether taken individually or in any combination desired.

In section 5 of the Office action, the Examiner indicated that claims 7-10 would be allowable if appropriately amended, for which the Applicant expresses appreciation. However, in light of the above amendment and remarks, it is respectfully submitted all claims (claims 1-16) of this application are now in an allowable form.

Accordingly, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

If there are any questions regarding this amendment, the Examiner is invited to call the undersigned at (310) 439-1800.

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November 22, 2005
Date Faxed

Respectfully submitted,

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